T. A. WILLARD.

STORAGE BATTERY.

APPLICATION FILED SEPT. 16, 1918.

1,425,924.

Patented Aug. 15, 1922.

2 SHEETS—SHEET 1.

Fig. 1.

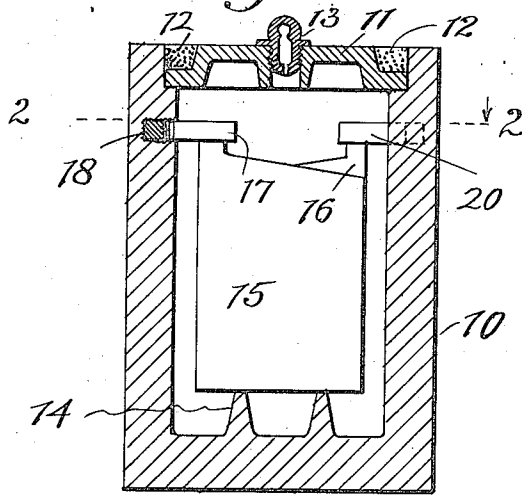
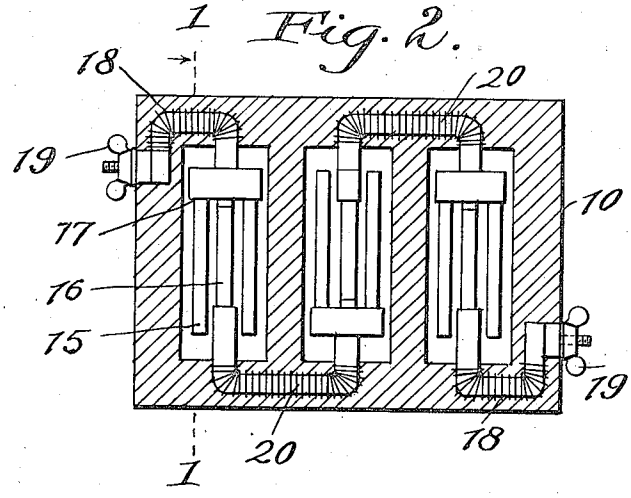


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

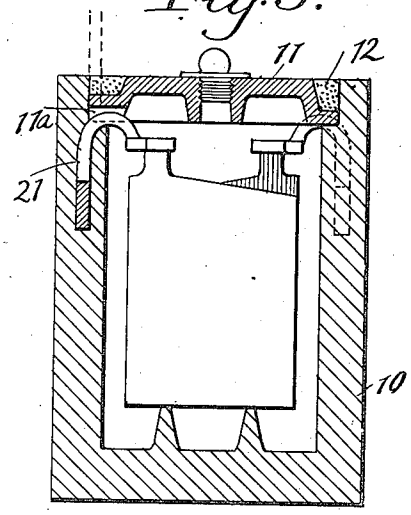


Fig. 4

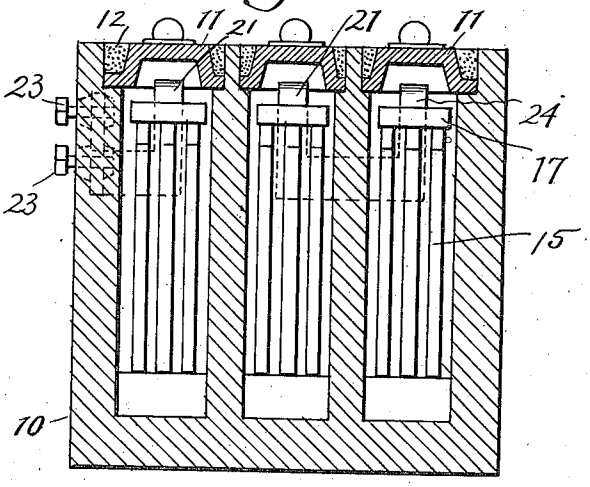


Fig. 6.

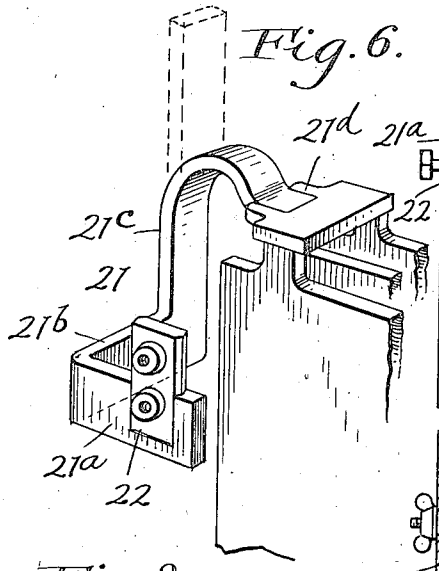


Fig. 5.

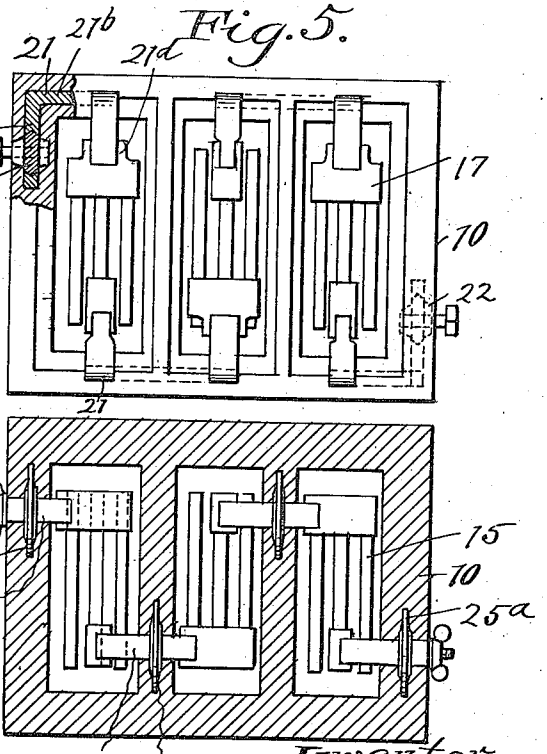


Fig. 8.

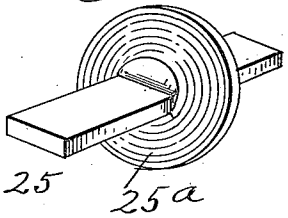


Fig. 7.

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UNITED STATES PATENT OFFICE.

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STORAGE BATTERY.

1,425,924. Specification of Letters Patent. Patented Aug. 15, 1922.

Application filed September 18, 1918. Serial No. 254,248.

To all whom it may concern:

Be it known that I, THEODORE A. WILLARD, a citizen of the United States, residing at East Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Storage Batteries, of which the following is a full, clear, and exact description.

This invention relates to certain new and useful improvements in storage batteries, and has for its chief object to provide a battery with the cover or covers of the cells free of terminal posts and connectors, and, in fact, of all obstructions, with the possible exception of vent plugs.

This is attained by extending the terminals of a cell through the lateral walls instead of the cover, and the invention is preferably carried out with a multi-compartment vessel or jar generally formed of rubber, by embedding the end terminals and the the cross connectors or terminals in the lateral walls, the two end terminals projecting outwardly through different sides of the vessel, and the cross connectors extending from cell to cell either through two opposite lateral walls around the dividing partitions, or directly through the partitions.

The invention may be further briefly summarized as consisting in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheet of drawings, Fig. 1 is a sectional view substantially along the line 1—1 of Fig. 2, looking in the direction indicated by the arrows; Fig. 2 is a horizontal sectional view substantially along the line 2—2 of Fig. 1, looking in the direction indicated by the arrows; Fig. 3 is a view similar to Fig. 1, showing a modification in the shape of the terminals and cross connectors; Fig. 4 is a sectional view of the same at right angles to the section of Fig. 3; Fig. 5 is a top plan view of the battery with the covers of the different cells removed; Fig. 6 is a perspective view of one of the end or terminal connectors removed from the walls of the jar and showing also portions of the plate connected to this connector; Fig. 7 is a horizontal sectional view through a battery constructed in accordance with another form of my invention; and Fig. 8 is a perspective view of one of the cross connectors removed from the battery.

In the drawings, and referring first to Figs. 1 and 2, 10 represents a multi-compartment jar or vessel which is preferably composed of hard, vulcanized rubber, of which storage battery jars are usually made, although in this instance the walls are somewhat thicker than is customary, and may have embedded therein strengthening devices of materials such as rubber covered cloth. In this instance, the jar has three compartments, although it may have a greater or less number.

Each compartment has a cover 11, sealed in place by a sealing compound 12, and in this instance provided only with a vent plug 13, since in accordance with my invention the covers are free of all terminal posts and cross connectors.

In each compartment, and supported on the usual upstanding ribs 14 are the positive and negative plates 15 and 16, of which there may be any number, and which may be connected or lead-burned to straps 17, in the customary manner.

The end terminals 18 extend laterally outward from the two end cells into the two opposite walls in which a substantial portion of the terminals are embedded, and then they extend for a distance through the other two opposite walls, and then out through the latter, so that flexible conductors may be attached thereto. In this case the extreme ends of the terminals 18 are provided with thumb nuts 19, although any other suitable form of binding post, or type of connector may be employed.

The cross connectors which are shown at 20, are in this case substantially U-shaped, their ends being attached to the positive and negative elements of adjoining cells and their middle portions being embedded in and for a distance extending lengthwise through the two opposite walls of the vessel around the partitions between adjoining cells, but at no point extending through the outer surface of said walls. The terminals 18 and cross connectors 20 which are preferably formed of lead or lead antimony, will, of course, be embedded in the walls of the vessel during its process of manufacture, while the rubber is in a plastic unvulcanized state, and the connections will subsequently

be made with the elements of the battery, preferably by lead-burning after the elements have been inserted into the several compartments. By forming the outer lateral walls of the vessel of superposed layers of plastic rubber, the embedding of the terminal and cross connecting conductors can be readily accomplished.

During the process of vulcanization the rubber will be vulcanized to the conductors 18 and 20, and to prevent creepage of battery solution along the conductors, the portions of the conductors which are embedded in the rubber are corrugated or threaded. By extending the embedded conductors for a distance lengthwise through the walls instead of more or less directly or transversely, liberal or ample portions of the conductors are wholly embedded in the rubber so that should the vulcanization be imperfect at any point, the possibility of leakage or creepage of battery solution along these conductors is practically negligible.

The principle of my invention may be utilized with embedded conductors differently formed and differently arranged than in the construction shown in Figs. 1 and 2. For example, in Figs. 3 to 6 I have shown a different form and a somewhat different arrangement of the conductors. In these views, the jar 10 is similar to that first described. The end or terminal connectors designated 21 are in the form of flat straps, each having a portion 21^a embedded in one end wall of the jar at a distance from the top of the latter, also a portion 21^b at right angles to the portion 21^a and embedded in one side wall of the jar, and a third portion 21^c at right angles to the portion 21^b and extending upwardly from the latter, this portion having its lower part embedded in the same side wall, and its top part protruding from the wall above the acid line at the flange or shoulder on which the associated jar cover 11 rests. Normally, or when the parts are embedded in the jar, the last mentioned parts of the end connectors extend upwardly above the jar, as shown by dotted lines in Figs. 3 and 6, and after the battery elements are inserted in the jar, these parts of the end connectors are bent downwardly and lead-burned to the straps to which the battery plates are secured, as shown at 21^d in Figs. 5 and 6. In this instance, the free ends of the end terminals are extended into slots of the straps, or between wings of the straps and lead-burned thereto.

In the outer ends of these end connectors, namely, in the part 21^a of each connector I prefer to embed or mold a bar 22 of brass or other good conducting material into which connecting screws such as shown at 23 may be threaded. As shown in Fig. 6, the bar 22 has bosses which receive the screws. The bosses on the outer side may extend outwardly flush or substantially flush with the outer surfaces of the jar.

The cross connectors which are shown at 24 are originally, or before they are connected to the battery elements, U-shaped, each having a middle portion which is wholly embedded in one of the side walls of the jar so as to extend around or on opposite sides of one of the dividing partitions, and each has upstanding end portions which emerge from the side wall on opposite sides of the partition, above the normal acid line of the cell and at the internal shoulders or ledges upon which the cell covers rest. After the battery elements are in place, the upstanding free ends of the cross connectors are bent inwardly and connected to the straps or plates as explained in connection with the end or terminal conductors.

With this construction, since the terminal and cross connectors emerge from the inner sides of the side walls of the jar, slightly above the bottom of the covers, the ends of the covers are provided with notched or elevated portions shown at 11^a in Fig. 3, adapted to fit down snugly over the adjacent portions of these conductors.

This construction has been found in practice, to be very effective, and it permits the connections to be made between the conductors and the battery elements without difficulty.

In Figs. 7 and 8 I have shown a construction wherein the terminal conductors and cross connectors extend more directly through the walls of the jar. In this instance the terminal conductors shown at 25, extend from the battery elements straight out through the end walls of the jar, and the cross connectors which are shown at 26, extend directly through the partitions of the jar. Since with this construction the lengths of the conductors 25 and 26 actually embedded and vulcanized in the walls of the jar are considerably less than with the constructions illustrated in Figs. 1 to 6, I prefer to provide some means to increase the creepage surface to avoid or minimize possibility of leakage, and in this case, this is accomplished by providing between the ends of the terminal connectors 25, outstanding flanges 25^a and between the ends of the cross connectors similar outstanding flanges 26^a, these flanges being embedded and vulcanized in the end walls of the jar and the partitions respectively. These flanges 25^a and 26a may be quite thin, and are preferably corrugated to increase their effectiveness.

With the improvements above described, that is, by having the connectors embedded in the lateral walls, without bringing the cross connectors to the outside of the battery at all, and by bringing the end con-

nectors through the lateral walls independently of the jar covers, there is no leakage and practically no corrosion which so frequently takes place above the covers of the battery when the latter are constructed in the customary manner. An equally important advantage lies in the ease with which the end connectors and cross connectors can be attached to the elements of the battery, for, since there are no terminal posts and no connectors to be brought through the cover, slight irregularities or inaccuracies in the relative locations of the parts to be connected have no effect whatsoever in the lead-burning operations by which the connections are made, nor do they to any extent alter the effectiveness of the connections or of the battery. The parts can therefore be made in great quantities and rapidly assembled without loss of time should there be slight inaccuracies of fit which heretofore were often troublesome.

Furthermore, the liability of breakage or short circuiting of the various conductors usually provided in the covers of the battery is much reduced, and the covers can be removed from the cells without disturbing any of the connections.

In the claims, the expression "lateral walls" is intended to include the side and end walls and dividing partitions of the jar, or all walls except the bottom and top walls or covers.

Other ways of carrying out the principle of my invention may occur to one skilled in the art, and I do not, therefore, desire to be confined to the precise details or arrangements shown, but aim in my claims to cover all changes or modifications which do not involve a departure from the spirit and scope of my invention in its broadest aspects.

Having described my invention, I claim:

1. A storage battery comprising a vessel having a cover and containing the electrolyte and battery elements and directly enclosing the same and conductors extending from the elements through the lateral walls of the vessel at a distance from and beneath the cover.

2. A storage battery container comprising a vessel having a cover and adapted to contain the electrolyte and positive and negative elements and having positive and negative conductors embedded in the lateral walls thereof, and projecting therethrough at points distant from and beneath the cover.

3. A storage battery composed of a unitary multi-compartment vessel for a number of cells, each compartment having positive and negative plates, and terminal and cross conductors which extend from cell to cell embedded in the lateral walls thereof.

4. A storage battery container comprising a single or unitary vessel with a number of compartments for different cells, each having a cover, the terminals of the battery being brought to the exterior of the vessel, and connections being made from cell to cell independently of the covers.

5. A storage battery comprising a vessel with dividing partitions forming compartments for a number of cells, positive and negative plates in each cell, cross connectors having their ends in different compartments and their middle portions embedded in lateral walls of the vessel, and the terminals of the end cells having portions embedded in the lateral walls and their ends projecting through two of the lateral walls.

6. A storage battery container comprising a vessel adapted to contain positive and negative plates and having terminal members each embedded in and extending for a distance through two lateral walls of the vessel.

7. A storage battery container comprising a unitary vessel with partitions forming several compartments for different cells, and cross connectors embedded in lateral walls of the vessel and extending around the partitions.

8. A unitary storage battery container having a number of separate compartments for different cells, and having cross connectors embedded in its walls beneath the top thereof and extending from cell to cell.

In testimony whereof, I hereunto affix my signature.

THEODORE A. WILLARD.